(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 602 753 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93203555.3**

(51) Int. Cl.5: **E21B 10/12**, E21B 10/52

(22) Date of filing: **16.12.93**

(30) Priority: **17.12.92 IT MI921069**

(43) Date of publication of application:
22.06.94 Bulletin 94/25

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE

(71) Applicant: **CBK TRADING S.r.l.**
Via Cesare Cantu, 13
I-22036 Erba (Como)(IT)

(72) Inventor: **Arnoldi, Luigi**
c/o CBK Trading S.r.l.,
Via Cesare Cantù, 13
I-22036 Erba (Como)(IT)

(74) Representative: **Fusina, Gerolamo et al**
Ing. Barzanò & Zanardo Milano S.p.A,
Via Borgonuovo, 10
I-20121 Milano (IT)

(54) Cutting disk for rock and similar materials.

(57) A cutting disk for rock and similar materials, comprising a wear tool (14) ring housed on a support element (12,13) which can be constrained to the casing (11) of a roller of a cutting head for mills, in which disk the wear tool ring (14) is constituted by a plurality of parts (15) with circular sector shape.

The circular sector shaped parts (15) are modular and interchangeable and the support element is constituted by a pair of annular elements (12,13) which are positioned on opposite sides relatively to the wear tool (14), and are constrained to one another by means of fastening elements (19).

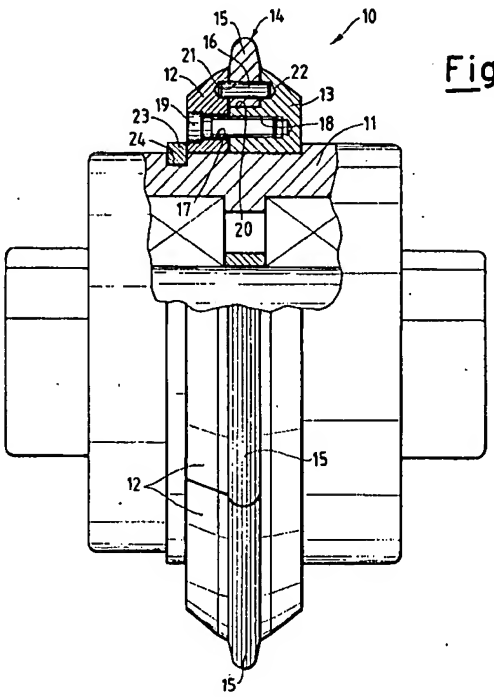


Fig.1

EP 0 602 753 A1

The present invention relates to a cutting disk for rock and similar materials.

In the excavations of rock or similar materials, after the use of the button rolls, how given up owing to its high cost and reduced penetration power, the disk rolls have been adopted, which yielded very good results.

In fact, the disk, by revolving and cutting along essentially its peripheral edge, makes it possible the rock penetration rate to be maximized.

In practice, the higher thrust power and the large moment of inertia correspond to an as high rock penetration rate.

In that way, it was possible to develop machines which can transmit to the rolls thrusts of the order on 35 tons.

The scaling up from the few tons of thrust per roll to the tens of tons of the present machines always met with a critical point which is represented by the cutting tool, i.e., by the disk.

This is so,because the roll, by now installed on shafts of proper size and with the aid of modern bearing which can bear really enormous thrusts, continues to display, as its critical point, the disk, i.e., the construction and designing thereof.

In fact, it is well known that the particularly advanced technology which have developed heretofore, make it possible rolls to be built whcih could be used for much longer time periods. Unfortunately, this is not possible at present, owing to the disks still displaying a decidedly shorter operating time than the other components of the same roll.

Furthermore, it should anyway be taken into account the fact that the disk is also that portion of the roll which is submitted to the largest stresses, which are such as to cause a rapid wear thereof.

Furthermore, a worn off disk displays a poor rock penetration power and, consequently, a large increase in friction. Therefore, on the field the revolution speed is considerably increased in order to reach the same feed rate, and eventually, in order not to irreparably compromise the structure of the roll, the thrust has to be decreased and, consequently, the production rate decreases, with a general increase in costs and times.

Therefore, the wear of the disk requires that the rolls and/or the disk are frequently replaced, an operation which, as a matter of fact, requires that the mill is stopped and the production is discontinued, with the attending personnel being possibly not properly used. Furthermore, one should also consider that a more frequent replacement of the disk may cause damages to the integrity of the other components of the same roll.

The purpose of the present finding is of addressing most problems which presently affect the disks, as mentioned hereinabove.

A further purpose is of taking advantage, as far as possible, of the characteristics of the material used, in order to achieve higher disk penetration rates with lower and lower friction on the rock, and, possibly, with minimal values of the moment of inertia.

A further purpose is of reaching the optimal exploitation of the power of the mill, and reducing the specific energy consumption per each m^3 of excavated rock.

These purposes according to the present finding are achieved by providing a cutting disk for rock and similar materials, which is constituted by a wear tool ring housed on a support element which can be constrained to the casing of a roller of a cutting head for mills, characterized in that said wear tool ring is constituted by a plurality of parts with circular sector shape.

Advantageously, also said support element is constituted by a pair of annular elements positioned on opposite sides relatively to the wear tool.

In such a way, any worn off parts can be rapidly replaced, with the surfaces of the casing on which both the wear tool ring and the support elements are housed, remaining unaltered and in their original condition.

The advantages and characteristics of a disk according to the present finding will be better evident from the following exemplifying, non-limitative disclosure, made by referring to the accompanying schematic drawings, in which:

Figure 1 is an elevation, partially sectional view of a disk according to the present finding installed on the casing of a roll of a cutting head for mills,

Figure 2 is a plan, partially exploded, view of the disk of Figure 1, and

Figure 3 is a sectional view of a portion of a further exemplifying embodiment of disk according to the present invention.

Referring to Figures 1 and 2, a cutting disk for rock and similar materials is schematically illustrated, which is generally indicated with 10, and is installed on board of the casing 11 of a roll of a cutting head for mills, suitably linked onto a revolving shaft.

The disk 10 is composed by two support elements 12, 13, between which a tool ring 14, acting as the cutting element, is installed. In general, the ring 14 is constituted by a hard metal, suitably studied for shape and alloy, firmly linked to the support elements 12, 13.

In the illustrated ring embodiment, the tool ring 14 of hard metal is composed by three modular sectors 15, e.g., having a circle-arc shape, and extending over an angle of 120°, which are equal to each other and interchangeable, in such a way that, once installed, they will form a complete ring. The

wear tool ring 14 displays a symmetrical cross section and one of such modular sectors 15 is shown in exploded view in Figure 2.

Said modular sectors 15, or, anyway, the tool ring 14, are is correctly positioned inside a relevant hollow seat 20 peripherally provided on the support element 13, which is made in the form of an enblock ring, and is facing inwards, i.e., opposite to the other support element 12. The correct positioning of the modular sector 15 relatively to the support elements 12 and 13 is furthermore accomplished thanks to the presence of elastic pins 16 which can be slid into through-bores 21 provided through the modular sectors 15 and inside blind bores 22 provided inside the support elements 12 and 13.

The whole positioning of the cutting disk 10 is finally accomplished by lining up through-bores 17 and threaded bores 18 provided through and, respectively, inside both mutually facing support elements 12 and 13, respectively. Said support elements 12 and 13 are constrained to each other by entering relevant fastening elements, as screws 19, into the mutually lined-up bores 17 and 18, so as to realize the above said cutting assembly.

It should be observed that in the end assembled position, the cutting disk 10 is housed on the casing 11 of the roll and is fastened in its position by means of an elastic ring 23 which can be housed inside a ring groove 24 provided in said casing.

However, it is not excluded that, according to an alternative exemplified embodiment, the tool ring 14 may be made as one single piece, with, however, the problems relating to manufacturing such an enblock piece of hard metal, remaining untouched.

In the illustrated embodiment, the support elements 12 and 13 are constituted by anular elements separate from the casing 11 of the roll. More precisely, said support element 13 is made, as said, as one single enblock, ring-shaped piece, and the support element 12 is realized as three mutually equal sectors each of which extends in circle-arc fashion over an angle of 120°, and all of which, once installed, will form a ring-shaped element. Therefore, the disk 10 will be mounted on the casing 11 of the roll first by inserting the support element 13, then positioning, through the elastic pins 16, the tool ring 14, whether made as one single enblock part, or as a plurality of parts, and finally housing the second support element 12, or the three sectors which constitute it.

After having carried out such operations, the elastic ring 23 will be positioned inside the groove 24 provided in the casing 11, after fastening the support elements 12 and 13 to each other by means of screws 19.

Such a sequence of operating steps used at assembly time can be validly used in the reverse order, for dismantling and replacing any possibly worn off parts. Furthermore, should the support parts of the roll, or the roll bearings (not illustrated) undergo irreversible damages, the whole disk 10, i.e., the support elements 12 and 13 and the tool ring 14 can be recovered. All the above makes it possible considerable savings to be accomplished in servicing costs, operating times and purchasing costs for cutting head component parts.

According to another embodiment selected, one of the support elements, e.g., the support element indicated with 13, could be integrated in the casing 11, so as to constitute an enblock piece with it. In this case, the tool ring 14 of hard metal, or its modular sectors could be directly positioned on their relevant seat 20. The end assembly of the cutting disk could be carried out by installing the second support element 12, as a fastenable element to casing 11. The removability of the second support element 12 would allow the ring 14 or wear element to be totally or partially replaced, in this case too, without having to dismantle the roll from the mill head.

Figure 3 displays a further, alternative exemplifying embodiment of the present finding, in which support elements 112 and 113 equal to each other are provided. In both said support elements 112 and 113, on their inner, mutually facing surfaces, seats 120 are provided which are suitable for housing a tool ring 114.

Also in this case, the tool ring 114 can be constituted by a plurality of parts with circular sector shape, which are modular and interchangeable. The tool ring 114, or its modular portions, are provided with through-bores 122 which can be lined-up to bores 117 and 118 provided through the support elements 112 and 113. In that way, both the linkage between the support elements 112 and 113, and, directly, fastening the tool ring 114 and/or its modular parts, can be accomplished by means of screws 119.

One will also observe that, in the embodiment displayed in Figure 3, the wear tool ring 114 has a cross-section in which a side 125 of said cross-section has a not very inclined direction, i.e., a nearly vertical direction, and, on the contrary, the other side 126 extends according to a rather inclined direction. A wear tool ring 114 may be given such a shape in order that the wear deriving from the penetration compensates for the wear caused at furrow exiting, producing a self-sharpening action and, above all, reducing the friction undergone by the tool when entering into and leaving from, the material to be cut.

Claims

1. Cutting disk for rock and similar materials, constituted by a wear tool ring housed on a support element which can be constrained to the casing of a roller of a cutting head for mills, characterized in that said wear tool ring is constituted by a plurality of parts with circular sector shape.

2. Cutting disk according to claim 1, characterized in that said circular-sector shaped parts are modular and interchangeable.

3. Cutting disk according to claim 1, characterized in that said support element is constituted by a pair of annular elements positioned on opposite sides relatively to said wear tool and constrained to each other by means of fastening elements.

4. Cutting disk according to claim 3, characterized in that at least one from said pair of anular elements which constitute said support element is provided with a peripheral inwards-facing hollow portion which partially houses said wear tool.

5. Cutting disk according to claim 3, characterized in that said fastening elements are housed inside through-bores provided through said wear tool.

6. Cutting disk according to claim 1, characterized in that at least a portion of said support element is provided integral with said casing of said roll.

7. Cutting disk according to claim 3, characterized in that at least one of said annular elements of said support element is constituted by a plurality of parts having a circular sector shape.

8. Cutting disk according to claim 1, characterized in that said wear tool ring displays a symmetrical cross-section.

9. Cutting disk according to claim 1, characterized in that said wear tool ring displays a cross-section, a side of which has an essentially vertical direction, and the other side of which extends according to an inclined direction.

10. Cutting disk according to claim 3, characterized in that between said tool ring and said annular elements of said support element, elastic pins are inserted.

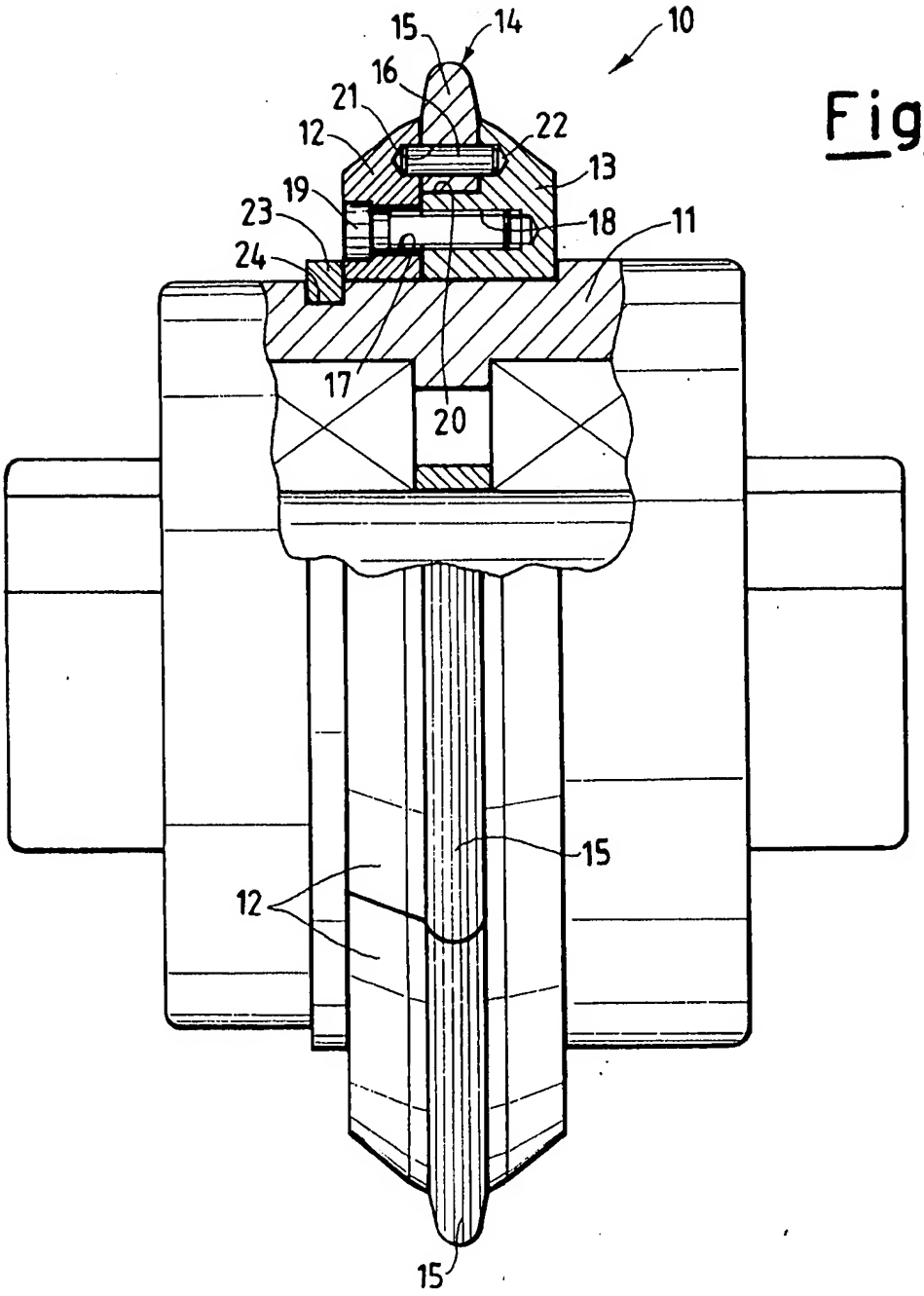

10
14
15
16
21
12
22
13
19
23
18
11
24
17
20
15
12
15

Fig.1

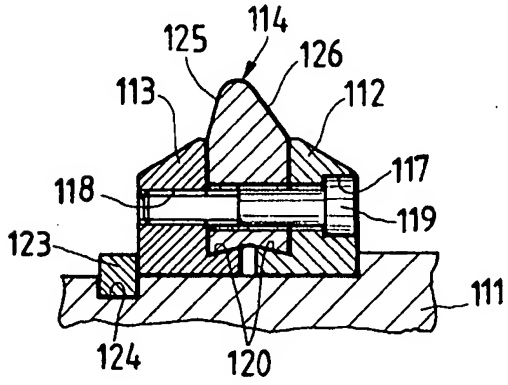
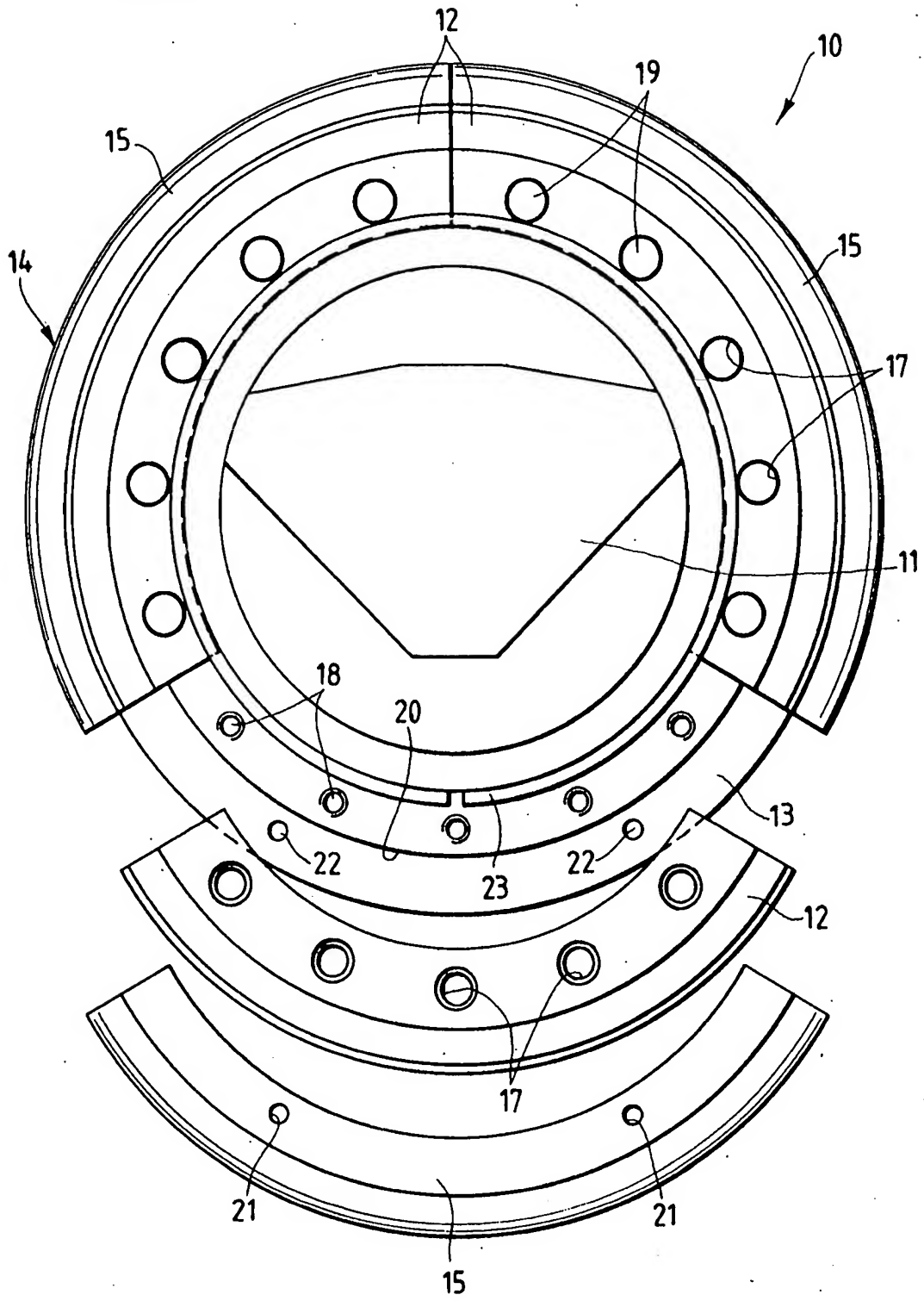

114
125
126
113
112
117
118
119
123
111
124
120

Fig.3

Fig.2



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 20 3555

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X Y	US-A-3 981 370 (BINGHAM) * column 1, line 54 - line 67; figures *	1,2,6,8 3-5,7,9	E21B10/12 E21B10/52
Y	US-A-1 143 275 (HUGHES) * figures 4-9 *	3-5,7,9	
X	US-A-4 004 645 (REES) * figures *	1,2,8	
A	US-A-3 766 998 (BOWER) * figures *	3	
A	FR-A-2 593 548 (BOART) * figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 March 1994	Weiand, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)